Two new species of *Solanum* (Solanaceae) from the Northern Territory, Australia

A.R. Bean

Summary

Bean, A.R. (2016). Two new species of *Solanum* (Solanaceae) from the Northern Territory, Australia. ***Austrobaileya* 9(4): 524–533.** Two new species, *Solanum ultraspinosum* A.R.Bean and *S. apodophyllum* A.R.Bean are described and illustrated, and maps of their distribution provided. Both are related to *Solanum clarkiae* Symon. A key to the species comprising the *S. clarkiae* complex is provided.

Key Words: Solanaceae, *Solanum*, *Solanum apodophyllum*, *Solanum clarkiae*, *Solanum ultraspinosum*, Northern Territory flora, new species, taxonomy, distribution maps, identification key

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Introduction

The informal '*Solanum dioicum* species group' (Whalen 1984; Bean 2004) is confined to tropical Australia. The member species are characterised by either the dioecious habit (separate male and female plants), or the inflorescences strongly andromonoecious (a single hermaphrodite flower at the base of the cyme with numerous male flowers above it).

Martine *et al.* (2006) published a phylogenetic analysis of the *Solanum dioicum* species group based on data from the ITS gene region, and recovered five clades: Clade 1 comprising nearly all the dioecious species; Clade 2 comprising *S. heteropodium* Symon and *S. oedipus* Symon (both andromonoecious); Clade 3 comprising *S. beaugleholei* Symon, *S. chippendalei* Symon, *S. diversiflorum* F.Muell. and *S. phlomoides* A.Cunn. ex Benth. (all andromonoecious); Clade 4 comprising *S. clarkiae* Symon and *S. melanospermum* F.Muell. (both andromonoecious); and Clade 5 comprising two dioecious species from Kakadu National Park, *S. sejunctum* Brennan, Martine & Symon and *S. asymmetriphyllum* Specht. Martine *et al.* (2009) examined further gene regions, resulting in the same clades, but with improved resolution in some areas.

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Solanum clarkiae was described by Symon (1981), typified by a collection from near Oenpelli, in the Northern Territory, Australia. Morphologically, *S. clarkiae sens. lat.* has been recognised amongst its congeners by the non-clonal habit (Symon 1981; Brennan *et al.* 2006), the entire or shallowly lobed leaves lacking glandular hairs, the andromonoecious inflorescences, the relatively long styles, 13–20 mm long (Martine *et al.* 2009), the pedicel of the bisexual flower 2.5–4 cm long (Symon 1981), the calyx lobes attenuate, 2.5–5 cm long (Symon 1981, as 'linear'), the calyx tube not markedly accrescent at the fruiting stage (Symon 1981), and the calyx strongly recurved at the fruiting stage (Symon 1981). However, even within these constraints, specimens currently identified as *Solanum clarkiae* exhibit a range of morphological variation that is greater than that generally accepted for other *Solanum* species. Two groups of specimens stand out from the rest, and two new species are described here to accommodate these, viz. *S. ultraspinosum* and *S. apodophyllum*. These can be consistently distinguished from specimens of *S. clarkiae* by readily observable characters.

The species of the *Solanum clarkiae* complex are geographically separated from nearly all species in the *S. dioicum* group – the exceptions are two dioecious species, *S. sejunctum* and *S. asymmetriphyllum*. Quite

apart from their sexual expression, the species of the *S. clarkiae* complex are unlikely to be confused with these two species, which are tall plants (up to 2 m high), with very few prickles (if any) on the stems, and an accrescent calyx tube that encloses the mature fruit.

Materials and methods

This study is based on morphological examination of herbarium specimens from AD, BRI, CANB and DNA. Measurements are based on dried material, except for the corolla, anthers and style, where measurements were made from material reconstituted using boiling water.

The lobing index (used in the descriptions below) is the ratio between the length of the lobe halfway along the lamina and the parallel length at the adjacent sinus (see Bean 2004: 641, 642). The leaves of *Solanum* spp. are typically oblique, with one side of the lamina shorter than the other. The obliqueness index is a measure of how oblique the lamina base is (see Bean 2004: 641).

The distribution maps were compiled using DIVA-GIS Version 7.5.0, using geocodes given on the specimens seen by the author. An abbreviation in the specimen and locality citations is NP for National Park.

Taxonomy

Key to the species of the *Solanum clarkiae* complex

1 Leaves sessile; stellate hairs on upper leaf surface all with lateral rays ± at right angles to central ray (porrect) . . . . . **S. apodophyllum**

1. Leaves petiolate, petioles 10–33% of lamina length; stellate hairs on upper leaf surface mostly with ascending lateral rays, although some porrect **2**

2 Fruiting calyx with 2300–2700 prickles; male flowers with pedicels 3–11 mm long . . . . . **S. ultraspinosum**

2. Fruiting calyx with 190–310 prickles; male flowers with pedicels 11–16 mm long . . . . . **S. clarkiae**

Solanum apodophyllum A.R.Bean **sp. nov.** with affinity to *S. clarkiae*, but differing by the sessile leaves, the geminate sympodia, and the stellate hairs of the upper leaf surface all porrect. **Typus:** Northern Territory. About 2.5 miles [4 km] SW of Mount Gilruth, 28 February 1973, *M. Lazarides 7940* (holo: CANB; iso: DNA).

Sprawling or erect shrub, 0.6–1.2 m high. Sympodia difoliate, geminate. Branchlets brown, stellate hairy; prickles 16–32 per cm, straight and broad-based, 1–4.5 mm long, 5–7 times longer than wide, glabrous. Branchlet stellate hairs moderately dense, 0.3–0.8 mm diameter, stalks 0–0.2 mm long; lateral rays 4–7, porrect; central ray 0.2–0.5 times as long as laterals, not gland-tipped; short glandular hairs absent. Adult leaves elliptical or ovate, 7.3–15.5 cm long, 3–7.2 cm wide, 1.8–2.4 times longer than broad, entire, prickles absent; stellate hairs not gland-tipped, simple hairs absent; short glandular hairs absent; apex acute, base auriculate. Petioles absent. Upper leaf surface grey-green; stellate hairs distributed throughout, moderately dense to dense, 0.15–0.4 mm apart, 0.5–0.7 mm across, stalks 0–0.2 mm long; lateral rays 4–8, porrect; central ray 0.4–0.8 times as long as laterals. Lower leaf surface greenish-white; stellate hairs moderately dense to dense, 0.2–0.4 mm apart, 0.5–0.7 mm diameter, stalks 0–0.2 mm long; lateral rays 5–8, porrect; central ray 0.3–0.8 times as long as laterals. Inflorescence leaf-opposed, cymose (pseudo-racemose), common peduncle absent, rachis prickles present, with one bisexual flower at base of rachis, the rest male; flowers 5-merous, corolla rotate, purple, outer surface lacking prickles. Male flowers: inserted along rachis; rachis 40–90 mm long, bearing 6–10 male flowers; pedicels at anthesis 6–10 mm

long, prickles present; calyx tube at anthesis 1.5–2 mm long; calyx lobes attenuate, 6–9 mm long; calyx prickles 60–125, 1–3.5 mm long; stellate hairs moderately dense to dense, transparent, 0.4–0.7 mm across, stalks 0–0.2 mm long, lateral rays 4–6; central ray 0.3–0.7 times as long as laterals; corolla 10–14 mm long; anthers 8.7–9.2 mm long; filaments *c.* 0.5 mm long; ovary glabrous. Bisexual flower: inserted at base of rachis; pedicel 27–34 mm long; calyx prickles 615–785, 1–9 mm long; stellate hairs dense to very dense, transparent, 0.6–0.7 mm across, stalks 0–0.4 mm long, lateral rays 4–7; central ray 0.3–0.6 times as long as laterals; corolla, 20–23 mm long, style 17–18 mm long. Fruits solitary, globular, 20–25 mm diameter, white, calyx tube not accrescent; calyx lobes exceeding mature fruit, strongly recurved; calyx prickles 900–1100, 2–12 mm long; pedicels 38–43 mm long; seeds not seen. **Figs. 1, 2**.

***Additional specimens examined*: Northern Territory.** Near Mt Gilruth, Mar 1984, *Craven 8293 & Wightman* (CANB, DNA); Mt Gilruth area, Arnhem Land, Jun 1978, *Henshall 1875* (DNA).

***Distribution and habitat*:** *Solanum apodophyllum* is confined to the Mount Gilruth area of western Arnhem Land, Northern Territory (**Map 1**).

***Phenology*:** Flowers recorded in February and March; fruits in June.

***Notes*:** *Solanum apodophyllum* is unique among Australian *Solanum* species because of its consistently sessile leaves. All leaves on the available herbarium specimens are sessile and auriculate. In *S. heteropodium*, a species from the Kimberley region of Western Australia, the upper leaves are "sessile or shortly petiolate" (Symon 1981), but the lower leaves have well-developed petioles.

S. apodophyllum differs from *S. clarkiae* by the geminate sympodia, the shorter central ray of the branchlet stellate hairs, the sessile leaves, the absence of prickles from either leaf surface, the porrect stellate hairs on the upper leaf surface, the shorter pedicels on the male flowers, the greater number of prickles on the bisexual flower calyx and on the fruiting calyx, and the longer anthers.

***Conservation status*:** As *Solanum apodophyllum* is confined to rugged sandstone terrain in western Arnhem Land, it is not thought to be under any threat. Population sizes are unknown however, and if surveys revealed that the total population was small, then its conservation status would need to be reconsidered.

***Etymology*:** From the Greek *apodus* – without a foot, and *phyllon* – a leaf. This is in reference to the sessile leaves present in the species.

Solanum ultraspinosum A.R.Bean **sp. nov.** with affinity to *S. clarkiae*, but differing by the many more prickles on the calyx of the male flowers, the bisexual flower, and the fruiting calyx, and by the shorter pedicels of the male flowers. **Typus:** Northern Territory. About 17 km SE of Jabiru, Kakadu National Park, 29 March 1981, *L.A. Craven 6598* (holo: CANB [2 sheets]; iso: DNA).

Sprawling or erect shrub, 0.6–1.2 m high. Sympodia difoliate, geminate. Branchlets white, grey or brown, stellate hairy; prickles 90–136 per cm, straight and acicular, 1–6 mm long, 11–15 times longer than wide, glabrous or with a few stellate hairs at base. Branchlet stellate hairs sparse to moderate, 0.25–0.6 mm diameter, stalks 0–0.2 mm long; lateral rays 3–6, porrect or ascending; central ray 0.5–1 times as long as laterals, not gland-tipped; short glandular hairs absent. Adult leaves elliptical or ovate, 5.2–14 cm long, 2.3–7.2 cm wide, 1.6–2.3 times longer than broad, entire or shallowly lobed throughout, with 0 or 3 lobes on each side, lobes acute or obtuse, lobing index 1–1.3, stellate hairs not gland-tipped, simple hairs absent; short glandular hairs absent; apex acute, base cuneate, obtuse or cordate, oblique part 2.5–16 mm long, obliqueness index 10–13 percent. Petioles 0.6–2.3 cm long, 12–25% length of lamina, prickles present. Upper leaf surface green; prickles absent or 1–3 on midvein only, straight and acicular, 2–3 mm long; stellate hairs distributed throughout, moderately dense to dense, 0.25–0.5 mm apart, 0.4–0.6 mm across, stalks 0–0.05 mm long; lateral rays 4–8, porrect or ascending; central ray 0.7–1.2 times as long as laterals. Lower leaf surface greenish-white, prickles absent or

Fig. 1. Holotype of ***Solanum apodophyllum*** (CANB).

Fig. 2. Portion of the holotype of ***Solanum apodophyllum***, showing inflorescences.

1–10 on midvein only, straight, broad-based; stellate hairs moderately dense to dense, 0.2–0.35 mm apart, 0.5–0.8 mm diameter, stalks 0–0.15 mm long; lateral rays 7–8, porrect or ascending; central ray 0.5–0.9 times as long as laterals. Inflorescence supra-axillary, cymose (pseudo-racemose), common peduncle absent, rachis prickles present, with one bisexual flower at base of rachis, the rest male. Flowers 5-merous; corolla rotate, purple, inner surface glabrous, outer surface lacking prickles. Male flowers: inserted along rachis; rachis 52–88 mm long, bearing 10–15 male flowers; pedicels at anthesis 2.5–11 mm long, prickles present; calyx tube at anthesis 1–2 mm long; calyx lobes attenuate, 6–10 mm long; calyx prickles 450–600, 1–7 mm long; stellate hairs dense to very dense, transparent, 0.25–0.4 mm across, stalks 0–0.1 mm long, lateral rays 5–8; central ray 1–1.5 times as long as laterals; corolla 10–13 mm long, anthers 7–7.6 mm long, filaments *c.* 0.5 mm long; ovary with short glandular hairs. Bisexual flower: inserted at base of rachis; pedicels at anthesis *c.* 20 mm long; calyx tube *c.* 3 mm long; calyx lobes attenuate, *c.* 24 mm long; calyx prickles 1500–2000, 2–11 mm long; stellate hairs sparse to moderately dense, transparent, 0.3–0.4 mm across, stalks 0–0.1 mm long, lateral rays 3–5; central ray 1–2 times as long as laterals; corolla and style not seen. Fruit solitary, globular, 23–26 mm

diameter, white, calyx tube not accrescent; calyx lobes exceeding mature fruit, strongly recurved; calyx prickles 2300–2700, 5–14 mm long; pedicels 20–29 mm long; seeds black, 2.7–2.9 mm long. **Figs. 3, 4.**

***Additional specimens examined*: Northern Territory.** Little Nourlangie Rock, Apr 1980, *Dunlop 5427* (AD, CANB, DNA, NSW); Koongarra Jump Up area, Apr 1980, *Dunlop 5506* (AD, DNA); Kakadu NP, Mt Brockman, Mar 1995, *Egan 4569* (DNA); Kakadu NP, 10 km NE of Namarrgon, Mar 1995, *Russell-Smith & Lucas 10300* (DNA); Little Nourlangie Rock, Kakadu NP, Apr 1980, *Telford 7796 & Wrigley* (CANB); Little Nourlangie Rock, Kakadu NP, Apr 1980, *Telford 7807 & Wrigley* (CANB); 2.5 km NW of Koongarra Saddle, Kakadu NP, Apr 1980, *Telford 8116* (CANB).

***Distribution and habitat*:** *Solanum ultraspinosum* is confined to the Mt Brockman – Nourlangie Rock area of Kakadu National Park, Northern Territory (**Map 1**). It grows on sandstone slopes and plateaux, in sandy or skeletal soil.

***Phenology*:** Flowers and fruits have been collected in March and April.

***Notes*:** *Solanum ultraspinosum* is closely related to *S. clarkiae*, but differs by the geminate sympodia; the greater number of calyx prickles on the bisexual flowers, male flowers, and fruits; the shorter pedicels of the male flower; the mostly smaller stellate hairs on the calyx; and the ovary with short glandular hairs (glabrous for *S. clarkiae*). The number of prickles occurring on the fruiting calyx (2300–2700) is far in excess of that found on any other Australian *Solanum* species, and perhaps greater than any other *Solanum* species in the world.

***Conservation status*:** As *Solanum ultraspinosum* is confined to rugged sandstone terrain in Kakadu NP, it is not thought to be under any threat. Population sizes are unknown however, and if surveys revealed that the total population was small, then some formal conservation status would be appropriate.

***Etymology*:** From the Latin *ultra* – beyond, and *spinosa* – thorny or prickly. This epithet is given in reference to the extremely prickly fruiting calyx, which bears between 2300 and 2700 prickles.

Solanum clarkiae Symon, *J. Adelaide Bot. Gard.* 4: 277 (1981). **Type:** Northern Territory. 16 km SW of the East Alligator River crossing on the road to Oenpelli, 11 June 1967, *D.E. Symon 5156* (holo: CANB; iso: AD, B, K, NSW, NT, US).

***Illustrations*:** Symon (1981: 278, 279).

Sprawling or erect shrub, 0.5–1.5 m high. Sympodia difoliate, disjunct. Branchlets green, yellow, rusty or brown; stellate hairy; prickles 10–104 per cm, straight and acicular, 1–9 mm long, 6–16 times longer than wide, glabrous. Branchlet stellate hairs sparse to very dense, 0.25–0.8 mm diameter, stalks 0–0.5 mm long; lateral rays 4–8, porrect or ascending; central ray 0.5–2.0 times as long as laterals, not gland-tipped; short glandular hairs absent. Adult leaves ovate to broadly ovate, 4.1–15.5 cm long, 2.1–9 cm wide, 1.2–2.8 times longer than broad, entire or shallowly lobed throughout, with 3–4 lobes on each side, lobes acute or obtuse, lobing index 1–1.4; stellate hairs not gland-tipped, simple hairs absent; short glandular hairs absent; apex acute, base obtuse or cordate, oblique part 2–24 mm long, obliqueness index 3–16 percent. Petioles 0.7–3.5 cm long, 10–33% length of lamina, prickles present. Upper leaf surface green, yellowish or grey; prickles 0–11, absent or present on midvein only, or present on midvein and lateral veins, straight and acicular, 1–7 mm long; stellate hairs distributed throughout, sparse to very dense, 0.05–0.8 mm apart, 0.4–1.2 mm across, stalks 0–0.2 mm long; lateral rays 4–10, ascending or rarely 2-tiered; central ray 0.6–1.3 times as long as laterals. Lower leaf surface green to yellowish or rusty, prickles 0–14, absent or present on midvein only, or on midvein and lateral veins, straight and acicular or broad-based; stellate hairs sparse to very dense, 0.05–0.6 mm apart, 0.5–1.2 mm diameter, stalks 0–0.4 mm long; lateral rays 5–10, ascending or rarely 2-tiered; central ray 0.5–1.4 times as long as laterals. Inflorescence leaf-opposed or supra-axillary, cymose (pseudo-racemose), common peduncle absent, rachis prickles present, with one bisexual flower at base of rachis, the rest male; flowers 5-merous, corolla rotate,

Fig. 3. Fruiting calyces of ***Solanum ultraspinosum*** (*Egan 4569*, DNA).

Fig. 4. Plant of ***Solanum ultraspinosum*** (*Telford 8116*, CANB). Photo: I. Telford.

purple, inner surface glabrous, outer surface lacking prickles. Male flowers: inserted along rachis, rachis 20–280 mm long, bearing 9–23 flowers; pedicels at anthesis 11–16 mm long, prickles present; calyx tube at anthesis 1.5–2.5 mm long; calyx lobes attenuate, 4.5–8 mm long; calyx prickles 50–110, 1.5–4.5 mm long; stellate hairs moderately dense to very dense, yellow or transparent, 0.35–0.8 mm across, stalks 0–1.1 mm long, lateral rays 5–8; central ray 0.8–1.8 times as long as laterals; corolla 10–13 mm long, inner surface glabrous or with a patch of simple hairs at each lobe apex; anthers 6.5–7.5 mm long; filaments 0.5–1 mm long; ovary glabrous. Bisexual flower: inserted at base of rachis; pedicels at anthesis 16–26 mm long; calyx prickles 180–250, 1.5–10 mm long; stellate hairs dense, transparent to yellow, 0.4–0.9 mm across, stalks 0–0.9 mm long, lateral rays 4–8; central ray 0.7–1.3 times as long as laterals; corolla 13–21 mm long, inner surface glabrous; style 13–16 mm long, glabrous; ovary glabrous. Fruits solitary, globular, 17–28 mm diameter, white at maturity, calyx tube not accrescent; calyx lobes exceeding mature fruit, strongly recurved; prickles 190–310, 1.5–12 mm long; pedicels 25–40 mm long; seeds black, 2.7–3 mm long.

***Additional selected specimens examined*: Northern Territory.** Marchinbar Island South, Hopeful Bay, Sep 1994, *Brennan 2913* (DNA); Near UDP Falls, South Alligator, Feb 1969, *Byrnes 1389* (AD, CANB, DNA); Birdie Creek, Kakadu NP, Apr 1990, *Cowie 1102 & Leach* (DNA, MEL, NSW); Magela Creek upper catchment, Arnhem Land, Apr 1995, *Cowie 5720* (DNA); E of Mann River, *c.* 64 km SSW of Maningrida, Arnhem Land, Mar 2000, *Cowie 8695* (DNA); Mt Bundey, Mary River NP, Dec 2010, *Cowie 12854 & Stuckey* (B *n.v.*, DNA); Between Kambolgie Creek and Plum Tree Creek, Kakadu Stage 3, Apr 1993, *Egan 2134* (DNA); Wessel Islands, Oct 1972, *Latz 3397* (BRI, CANB, DNA); Elcho Island, Jul 1975, *Latz NEAR 6259* (AD); Mt Bundey, Feb 1989, *Leach 2093 & Dunlop* (DNA); NW Cotton Island, Aug 1996, *Mangion 251* (DNA); Vicinity of El Sharana Mining camp, Jan 1973, *Martensz & Schodde AE389* (AD, CANB, DNA); Dharrway Swamp, Elcho Island, Jun 2004, *A.A. Mitchell 7784* (AD, CANB, DNA); W side of Raragala Island, Wessel Island group, Nov 2006, *A.A. Mitchell 8665* (AD, DNA); 14 km S of Cannon Hill, Kakadu NP, Jan 1984, *Russell-Smith 915* (DNA); Northern Outlier, Kakadu NP, Mar 1995, *Russell-Smith 9894* (DNA); 12 km NE of Jabiru airfield, Kakadu NP, Mar 1995, *Russell-Smith & Lucas 10012* (DNA); 12 miles [19 km] W of the East Alligator River crossing on the road to Oenpelli, Jun 1971, *Symon 7179* (AD, DNA, CANB); On road to Oenpelli from Pine Creek, some km from East Alligator River crossing, Jun 1975, *Symon 10347* (AD); 10 km SW of Oenpelli Aboriginal Settlement, May 1988, *Weber 9910* (AD, DNA); Katherine River, Nibuldakya, Jul 1997, *Wightman 7014* (DNA).

***Distribution and habitat*:** *Solanum clarkiae* is widely distributed across the Top End of Northern Territory, from Mt Bundey to the Wessel Islands, but mainly in Kakadu NP and western Arnhem Land (**Map 2**). It usually grows among sandstone boulders, or on sandy soils adjacent to sandstone outcrops, but is also recorded from a granite outcrop (Mt Bundey), and on swamp margins (Elcho Island).

***Phenology*:** Flowers are recorded from September to May; fruits are recorded from March to November.

***Notes*:** Apart from the two species described herein, *Solanum clarkiae* is most closely related to *S. melanospermum*. *S. clarkiae* differs by the shallowly lobed adult leaves (deeply lobed for *S. melanospermum*), the pedicels with stellate hairs throughout (glabrous at distal end for *S. melanospermum*), the greater number of calyx prickles on both the male and bisexual flowers, and the calyx prickles glabrous or with hairs at the very base of the prickle (hairs attached throughout most of the length of the prickle in *S. melanospermum*).

Solanum clarkiae is a variable species, notwithstanding the removal of *S. ultraspinosum* and *S. apodophyllum*.

Specimens from near the type locality have dense to very dense indumentum on the leaves, the number of male flowers is typically 9–13, and the rachis length is between 50–80 mm. Specimens from the more southerly parts of Kakadu NP have narrower sparsely hairy leaves and long petioles, with up to 23 male flowers on a rachis up to 280 mm long; specimens from Mt Bundey have sparsely hairy leaves with very short petioles. It is therefore possible that further taxa exist, but additional collections and field observations would be needed to determine the significance of the observed differences.

***Conservation status*: Least Concern**. The distribution of *Solanum clarkiae* is extensive, and much of it is in Kakadu NP and adjacent parts of Arnhem Land. There would appear to be no significant threats to its future survival.

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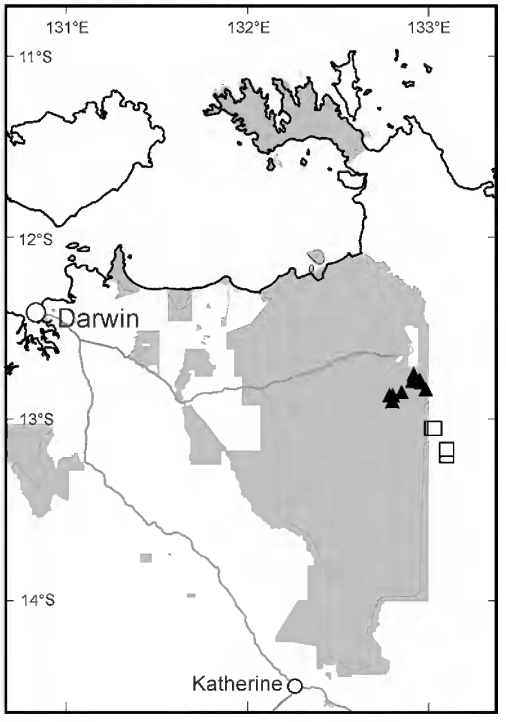
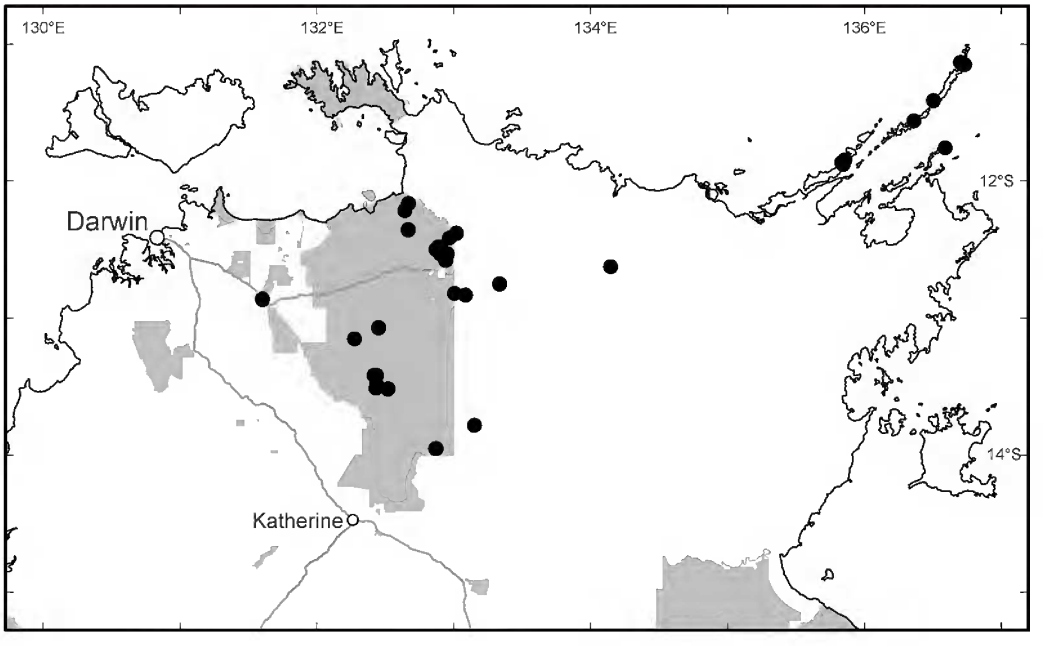


Map 1. Distribution of ***Solanum apodophyllum*** □ and ***S. ultraspinosum*** ▲ in the Northern Territory.



Map 2. Distribution of ***Solanum clarkiae*** in the Northern Territory.